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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. |
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09/160,454 09/24/98 BAWENDI

M

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EXAMINER

PHAM, M

ART UNIT

PAPER NUMBER

1641

9

DATE MAILED:

02/03/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/160,454

Applicant(s)

BAWENDI ET AL.

Examiner

Minh-Quan K. Pham

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-48 is/are pending in the application.
- 4a) Of the above claim(s) 46-48 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-45 is/are rejected.
- 7) ☒ Claim(s) 7 is/are objected to.
- 8) ☐ Claims ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are objected to by the Examiner.
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- a) ☐ All b) ☐ Some * c) ☐ None of the CERTIFIED copies of the priority documents have been:
1. ☐ received.
2. ☐ received in Application No. (Series Code / Serial Number) ____.
3. ☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

- 14) ☒ Notice of References Cited (PTO-892)
- 15) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 16) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 17) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 18) ☐ Notice of Informal Patent Application (PTO-152)
- 19) ☐ Other: _____.

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DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Group I, claims 1-45, in Paper No. 7 is acknowledged.

Claims 46-48 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to nonelected inventions, there being no allowable generic or linking claim.

Election was made **without** traverse in Paper No. 7.

Claim Objections

Claim 7 objected to because of the following informality: the word "association" is misspelled in the claim. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-45 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

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Claim 1 is vague and indefinite because it is not clear how the compound and the nanocrystal is "associated." Is the association a chemical bond, a close proximity, a chemical group association (belonging to the same family of chemical), etc.?

Claim 2 recites the limitation "the quantum dot" in line 2. There is insufficient antecedent basis for this limitation in the claim. ✓

Claim 11 is an incomplete sentence. The claim ends with a comma. ✓

The term "small" in claims 22-24 is a relative term which renders the claim indefinite. The term "small" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. From the specification and the prior art, it is not clear what the range is for a "small" molecule. Further, it is not clear whether "small" refers to size, weight, length, width, or distance ✓

The term "substantially" in claim 28 is a relative term which renders the claim indefinite. The term "substantially" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. ✓

Claim 31 is vague and indefinite. The claim appears to be incomplete because --and— should be present before "amine oxides" to close off the Markush group. ✓

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Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

Claims 1-27, 29, 31-32, 34-36, and 39, 41-45 are rejected under 35 U.S.C. 102(b) as being anticipated by Weiss et al. (US Pat. 5,990,479).

Weiss et al. disclose the use of quantum dots (semiconductor nanocrystal) as probes for biological application wherein the quantum dot is linked to an affinity molecule (see column 2 lines 18-37). The water soluble quantum dots include nanocrystals from group II-VI semiconductors such as ZnS, MgS, etc.; group III-V semiconductors such as GaAs, InGaAs, etc.; and group IV such as Ge, Si, etc. (see column 5, lines 60-67; column 6, lines 1-16; and column 10, line). The quantum dot emits electromagnetic radiation in the range of 200-2000 nm and has a wavelength band of emission not exceeding 40 nm at full width half maximum (FWHM), and preferably not exceeding about 20 nm at FWHM (see column 5, lines 1-10; and column 6, lines 36-47). The size of the quantum dot ranges from 20 Å to 100 Å and can contain a shell of another semiconductor nanocrystal material such as CdSe (see column 6, lines 17-35). The affinity molecules includes monoclonal antibodies, nucleic acids (monomeric or oligomeric), proteins, polysaccharides, sugars, peptides, drugs, and ligands (see column 6, lines 50-67; and

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column 7 lines 1-4) and can comprise avidin or streptavidin to detect the presence of biotin (see column 10, lines 15-19). The quantum dot is linked to the affinity molecule by a ligand which contains a hydrophobic region and a hydrophilic region (see column 8, lines 15-48). The hydrophilic region can be silanes, amines, phosphine oxides, thiol, phosphorus oxides, etc. (see column 7, lines 8-67; and column 8, lines 1-59). Therefore, Weiss et al. anticipate the invention as claimed.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 28 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weiss et al. (US Pat. 5,990,479) in view of Matsumoto et al. (1996), *J. Phys. Chem.*, 100(32):13781-13785.

See above for the disclosure of Weiss et al.

Weiss et al. do not disclose that the semiconductor nanocrystal exhibits less than 10% rms deviation in diameter.

Matsumoto et al. disclose semiconductor nanocrystals with size distribution of $\pm 8\%$ of the mean particle diameter (see page 13781, Introduction).

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Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the monodisperse nanocrystals of Matsumoto et al. in the composition of Weiss et al. because the monodisperse nanocrystals exhibit a more uniform emission spectrum.

Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weiss et al. (US Pat. 5,990,479) in view of Dabbousi et al. (1997), *J. Phys. Chem. B*, 101:9463-9475.

See above for the disclosure of Weiss et al.

Weiss et al., however differ from the claimed invention because they do not disclose that the quantum dot is a ZnS overcoated CdSe nanocrystal.

Dabbousi et al. disclose a ZnS overcoated CdSe ((CdSe)ZnS) nanocrystal exhibiting fluorescence quantum yield of 50% at room temperature (see Introduction).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use (CdSe)ZnS nanocrystal in the composition of Weiss et al. because (CdSe)ZnS nanocrystal has the advantage of a high fluorescence quantum yield (50% at room temperature).

Allowable Subject Matter

Claims 30 and 37-38 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

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Although the prior arts disclose a composition comprising a quantum dot linked to an affinity molecule for use in biological assays, they do not disclose that the ligand has the formula $H_zX((CH_2)_nCO_2H)_y$, where X is S, N, P, or O=P, $n \geq 6$, and z and y are selected to satisfy the valence requirements of X; and that the photoluminescence has quantum yields greater than 10% in water. Therefore, claims 30 and 37-38 would be allowable over the prior art.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Coffer et al. (1992), *Nanotechnology*, 3:69-76; Mahtab et al. (1995), *J. Am. Chem. Soc.*, 117:9099-9100; Lawton et al. (US Pat. 5,985,353); Mahtab et al. (1996), *J. Am. Chem. Soc.*, 118:7028-7032; and Murphy et al. (1997), *Mat. Res. Soc. Symp. Proc.*, 452:597-600 are cited to show quantum dots binding to DNA.

Lawless et al. (1995), *J. Phys. Chem.* 99:10329-10335. is cited to show the capping of quantum dots with mercaptocarboxylic acids.

Alivisatos et al. (US Pat. 5,751,018 and 5,505,928); Nirmal et al. (1996), *Nature*, 383:802-804; Alivisatos (1996), *J. Phys. Chem.*, 100:13226-13239; Bawendi et al. (1992), *J. Chem. Phys.*, 96(2):946-954; and Correa-Duarte et al. (1998), *Chem. Phys. Lett.*, 286:497-501 are cited to show various quantum dots, their construction, properties, and derivatives thereof.

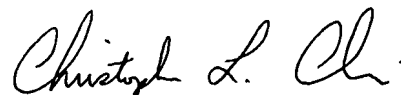
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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Minh-Quan K. Pham whose telephone number is (703) 305-1444. The examiner can normally be reached on Monday to Friday, 8 AM - 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, James Housel can be reached on (703) 308-4027. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-4242 for regular communications and (703) 308-4242 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0196.

Minh-Quan K. Pham
January 24, 2000



CHRISTOPHER L. CHIN
PRIMARY EXAMINER
GROUP 1800-1641